Overview of ESP

Ensemble Streamflow Prediction

ESP Trace Generation

CLIMATE FORECAST ADJUSTMENTS

HISTORICAL TIME SERIES

ALL YEARS OF RECORD

FORECAST TIME SERIES

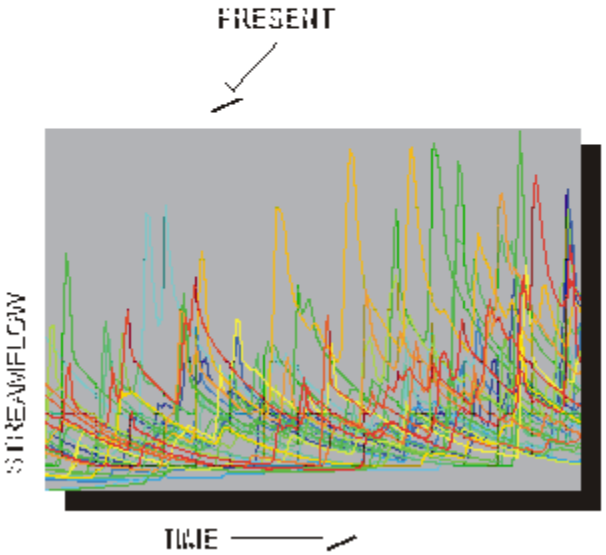
DAILY RFC FORECASTING
- DATA INGEST
- DATA QC
- MODEL UPDATING

CURRENT CONDITIONS
- SOIL
- SNOW
- RESERVOIR LEVELS
- STREAMFLOW

MEAN AREAL TIME SERIES

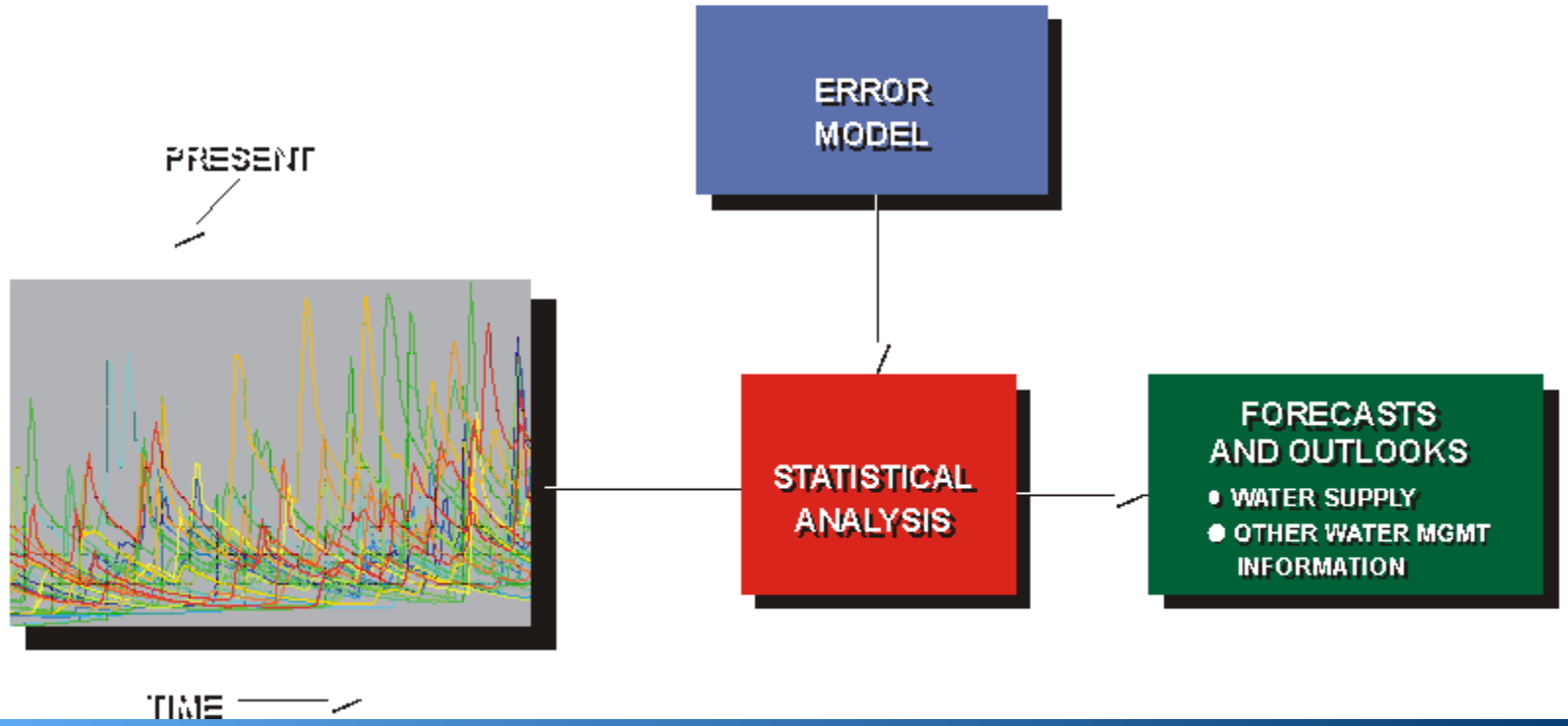
PRECIPITATION
TEMPERATURE

NWSRFS HYDROLOGIC MODELS



Introduction to ESP

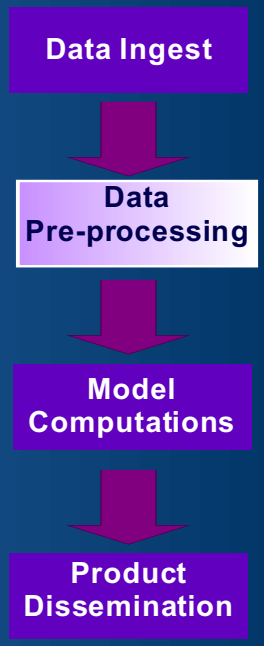
ESP Statistical Analysis



Computing the Input Ensemble

Currently Implemented Methods

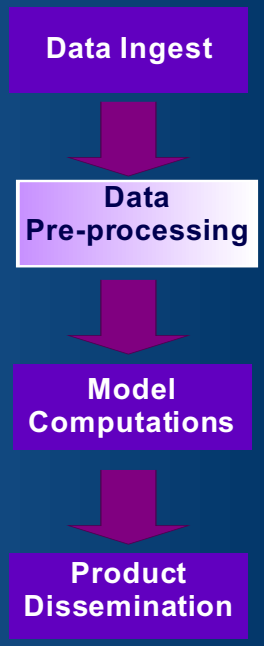
- Straight climate
- Linear Blending with QPF
- Distribution shifts based on long range forecasts
- 24 hour stochastic storm generation
- 24 hour stratified sampling



....Computing the Input Ensemble

More research is required

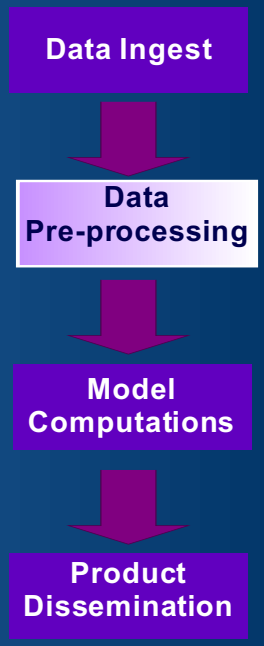
- Current methods for computing the input precipitation ensemble are cumbersome. They are either:
  - computationally expensive or,
  - difficult to implement on many basins or,
  - too simplistic.



A New Approach

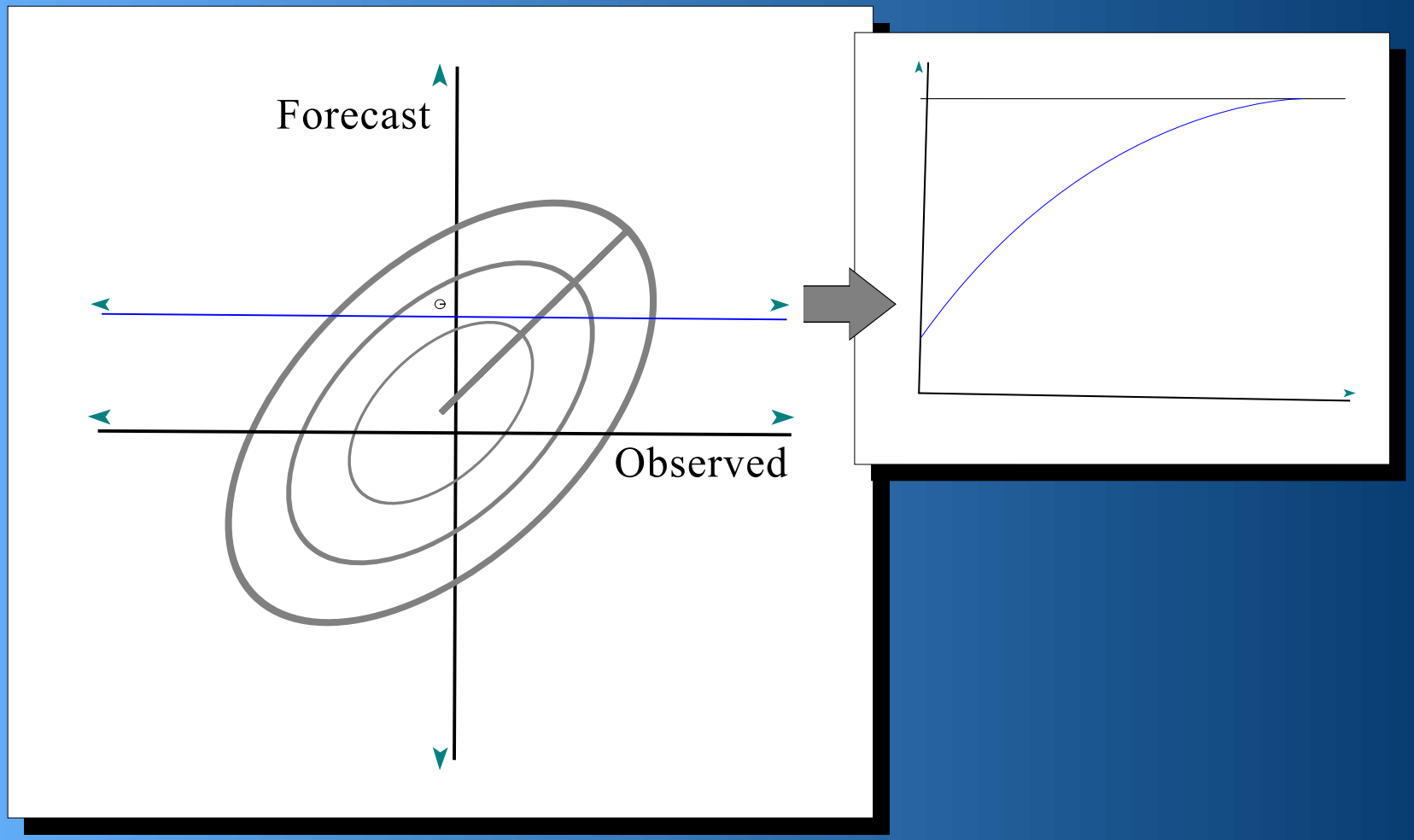
Designed for national implementation

- Uses existing data streams
- Can be implemented over numerous basins
- Can be implemented relatively quickly



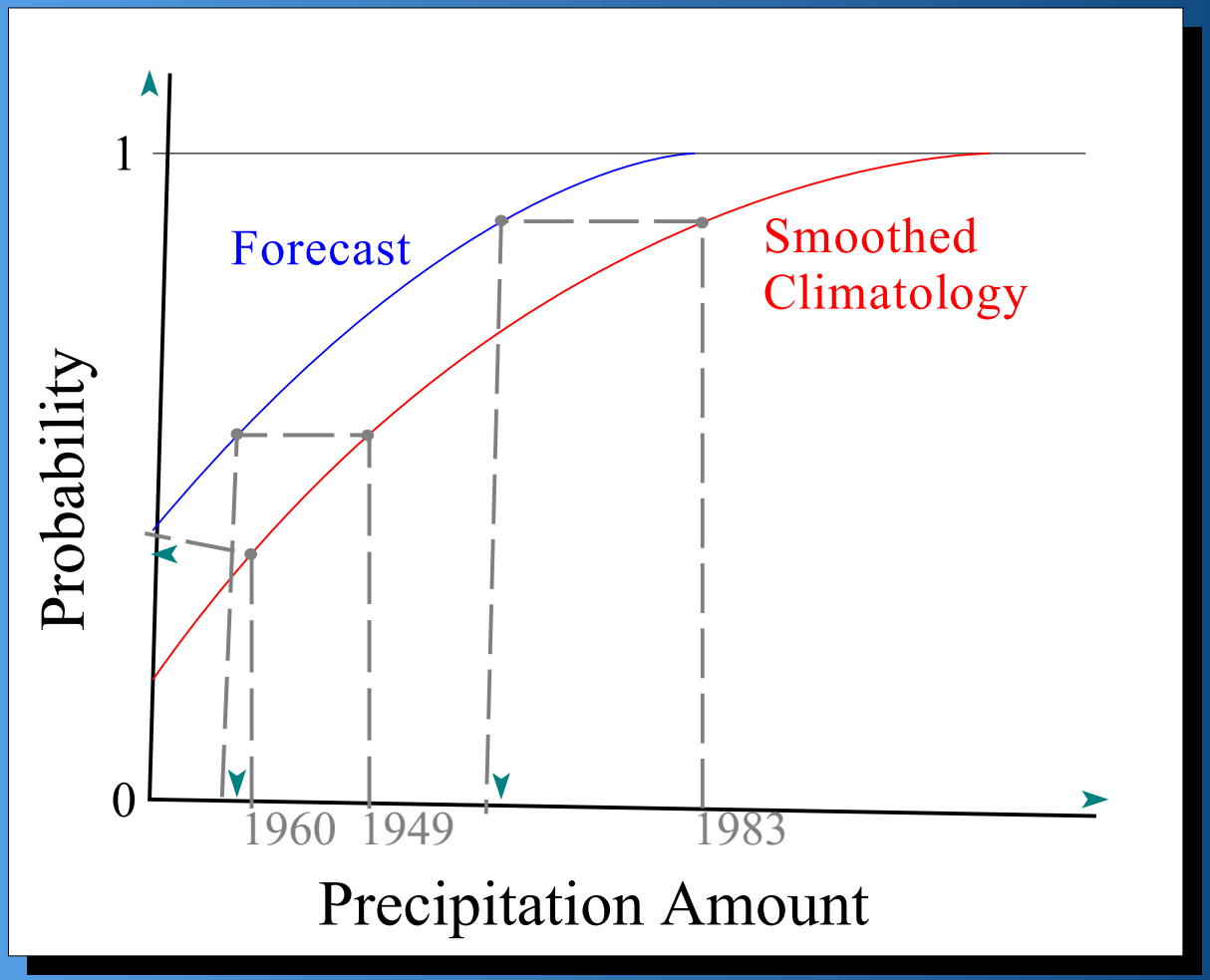
Deriving the Forecast Distribution

Given QPF



Pre-Processor

General Blending Procedure



Ensemble Post Processor

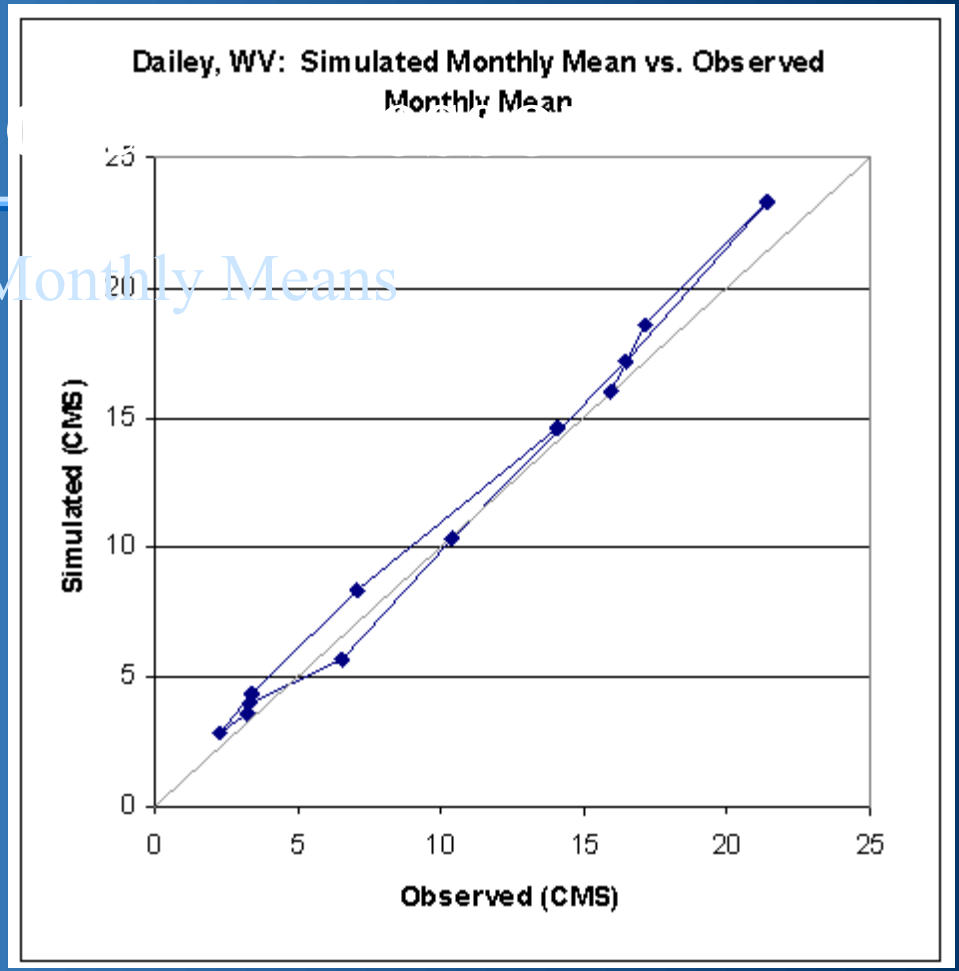
Removing Bias and Accounting for Uncertainty

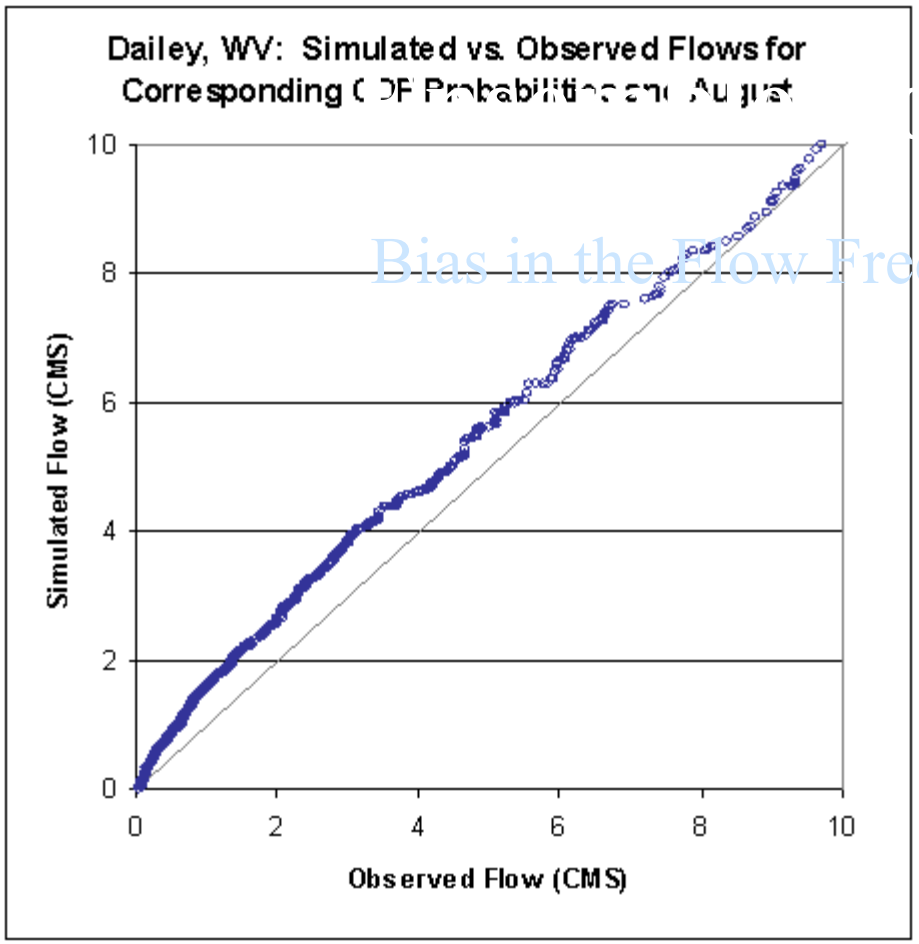
- Hydrologic models are biased
  - Monthly means
  - Daily flow frequency distribution
- Necessary to produce probabilistic river stage forecasts
  - Ensemble forecasts must be adjusted to give valid probability information

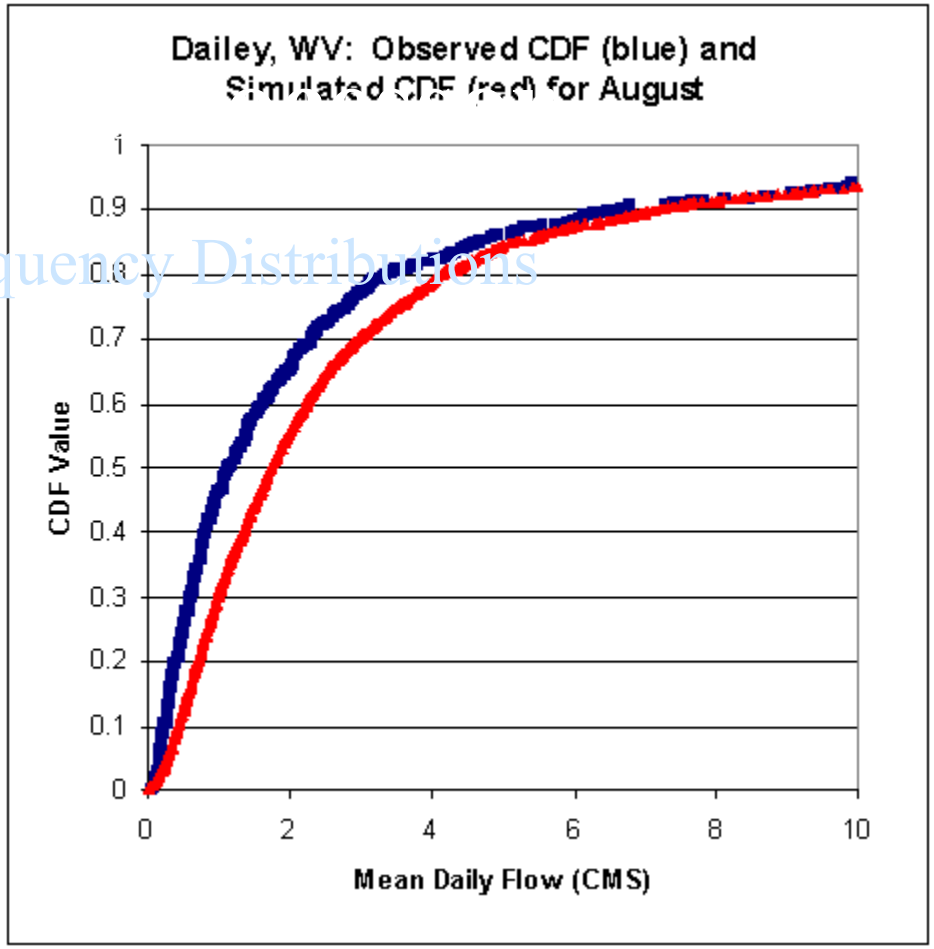
Ensemble P

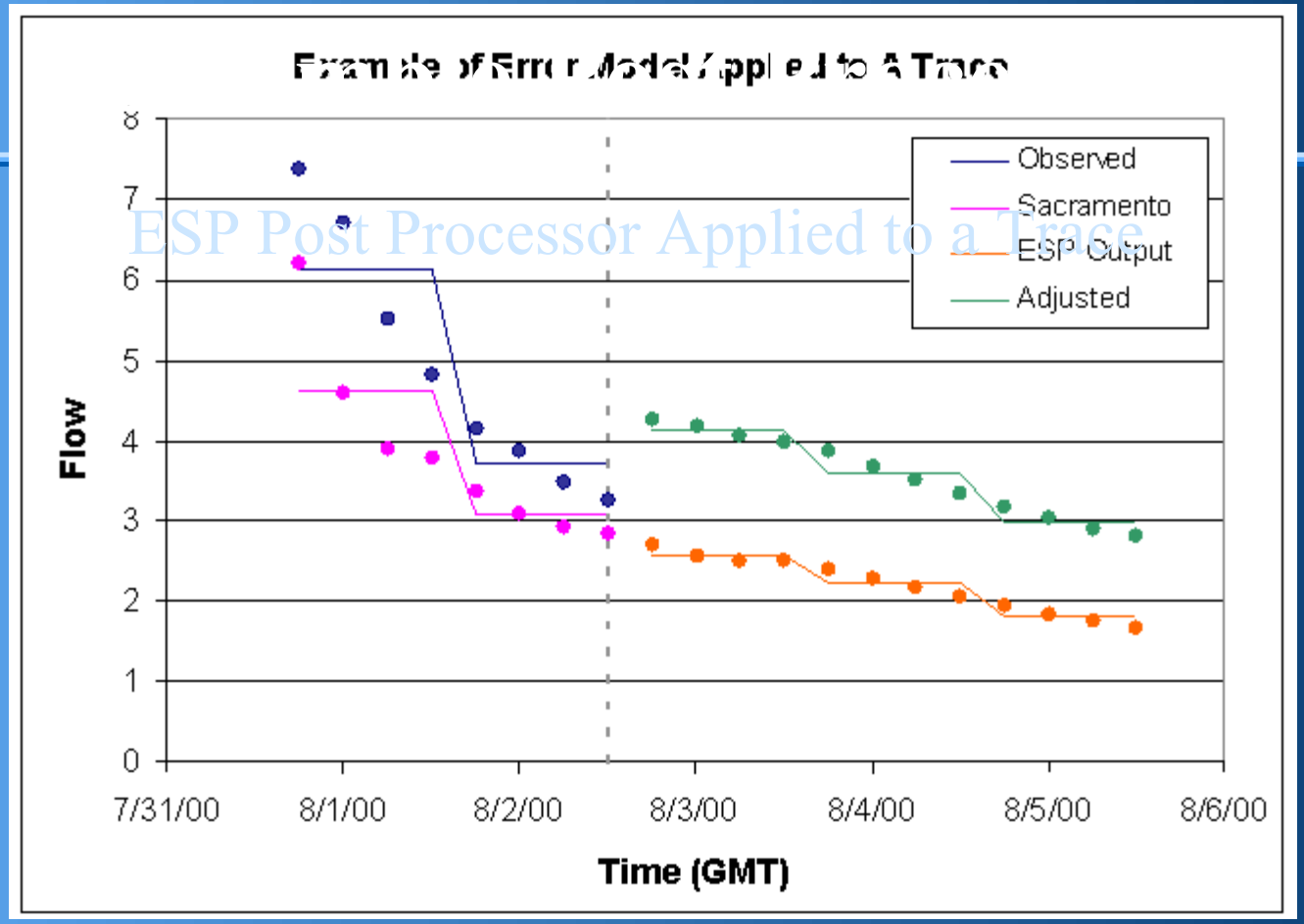
Bias in the Monthly Means

- Long-term monthly means of modeled daily flow are biased relative to observed daily flow








Example of Error Model Applied to A Trace
ESP Post Processor Applied to a Trace
Observed
Sacramento
ESP Output
Adjusted
Flow
0
1
2
3
4
5
6
7
8
7/31/00
8/1/00
8/2/00
8/3/00
8/4/00
8/5/00
8/6/00
Time (GMT)

Ensemble P

Adjusted Flow Frequency Distribution

- Effect of ESP Post Processor should not be analyzed by looking at an individual trace, but by looking at the adjusted distribution